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(54) **A multimode digital modem**

(57) A modem that operates selectively in the voice-band frequency band and at higher frequency bands is provided. This modem supports multiple line codes, like DMT and CAP.

The modem uses a Digital Signal Processor (DSP), so that different existing ADSL line codes, such as Discrete MultiTone (DMT) and Carrierless AM/PM (CAP), can be implemented on the same hardware platform. The modem negotiates in real-time, for a desired line transmission rate to accommodate line condition and service-cost requirement.

The line code and rate negotiation process may be implemented at the beginning of each communication session through the exchange of tones between the modems. A four-step MDSL modem initialization process is provided for line code and rate compatibility.

A new synchronization startup procedure for CAP based MDSL modems is provided. The handshake protocol and receiver algorithm allow reliable modem synchronization over severely amplitude distorted channels such as standard telephone twisted-pair wire. the algorithm makes use of a short length sequence to train a

synchronizing equalizer at the receiver. After training to this sequence, a matched filter or correlator is used to detect the inverted sync sequence. The detection of the inverted sequence signals the start of the normal reference training of the CAP demodulation equalizers.

The MDSL line connection management process provides a simple, efficient, and flexible interface to manage the line connection between MDSL-C (MDSL in Central Office site) and MDSL-R (MDSL in resident site) in the telecommunication Wide Area Networking environment. An internal state machine in an MDSL modem records and monitors the line status and notifies the state change to the other MDSL and also the host processor. The protocol used for exchanging line connection management messages is a simplified Link Control Protocol (LCP) for MDSL.

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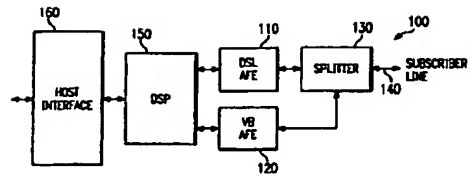


FIG. 1a



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EPO FORM 1508 08.02 (F04001)



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EPO FORM 1508 03/92 (P04021)



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Application Number
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Application Number
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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

- ☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):
- ☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

- ☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.
- ☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.
- ☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:
- ☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:



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**LACK OF UNITY OF INVENTION
SHEET B**

Application Number
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The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. Claims: 1-4

Wireless point-to-multipoint distribution system

2. Claims: 5-8

Equalizer for dual channel communication

3. Claims: 9-10

DSL modulation and demodulation

4. Claims: 11-12

Multistage modulation and demodulation with variable scaling

5. Claims: 13-15

Multimode modem

6. Claim : 16

Multi-link modem

7. Claim : 17

Link connection management process

8. Claim : 18

Modem identification method

9. Claims: 19-23 25-26

Rate negotiation process

10. Claim : 24 27

Modem initial synchronization

11. Claim : 28



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**LACK OF UNITY OF INVENTION
SHEET B**

Application Number
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The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

Video conferencing

12. Claim : 29

Interfacing modem hardware with a host operating system

13. Claim : 30

Modem upgrade

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